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LIQUID DETERGENT COMPOSITION FOR HARD SURFACE

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LIQUID DETERGENT COMPOSITION FOR HARD SURFACE

|            |  |
|------------|--|
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Claim

1. A liquid detergent composition for a hard surface whose pH is 6-13 and containing (A) 0.01-20 wt% surfactant, (B) 0.01-20 wt% solvent which can be represented by  $\text{ROC}_3\text{H}_6\text{OH}$  [R: C2-6 alkyl or alkenyl group], and (C) 3-20 wt% amine compound.

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\* [Numbers in the right margin indicate pagination of the original text.]

### Detailed description of the invention

[0001]

#### Technical field of the invention

The present invention pertains to liquid detergent composition for a hard surface having excellent detergency and causing little damage to the surface being washed such as a hard plastic surface.

[0002]

#### Prior art and its problems

When stains adhered to a ventilation fan, a wall surrounding a kitchen, glass, a refrigerator, etc., and are left for a long period of time, they oxidize and become sticky with deteriorated grease.

[0003]

As a detergent for removing such greasy stains, a detergent with an inorganic strong alkali such as sodium carbonate, sodium hydroxide, etc., as the main component or a detergent with a water-soluble organic solvent such as a lower alcohol, glycol ether, etc., as the main component are known.

[0004]

However, in recent years styrene-based plastics such as ABS polymers have been used in many household electric appliances and in the interiors of automobiles, and as described in Japanese Kokoku Patent No. Hei 4[1992]-73478, when detergent compositions containing glycol ether-based solvents were used for washing the hard surface of plastics, cracks sometimes formed on the hard surface of the plastics.

[0005]

The objective of the present invention is to provide a detergent composition which exhibits excellent detergency with respect to grease stains and causes little damage to the surface of plastic products when the detergent composition is used in cleaning plastic products.

[0006]

#### Means for solving the problems

The present invention provides a detergent composition whose pH is 6-13 and containing (A) 0.01-20 wt% surfactant, (B) 0.01-20 wt% solvent, which can be represented by  $\text{ROC}_3\text{H}_6\text{OH}$  [R: C2-6 alkyl or alkenyl group], and (C) 3-20 wt% amine compound.

[0007]

## Embodiment of the invention

For the surfactant which is component (A) of the present invention, the use of an anionic surfactant, nonionic surfactant, or amphoteric surfactant is preferable; however, if necessary, a cationic surfactant may also be used.

[0008]

For the anionic surfactant, those described in Japanese Kokai Patent Application No. Hei 9[1997]-359715 or Japanese Kokai Patent Application No. Hei 9[1997]-310091 (line 44, 13th column, p.8, to line 14, 15th column, p. 9) can be given as examples, but among them the following (1)-(5) are preferable and (2) is especially preferable.

[0009]

(1) Alkylbenzenesulfonic acid or thereof salt with a C8-22 linear alkyl group.

(2) Polyoxyalkylene alkyl ether sulfuric acid, polyoxyalkylene alkenyl ether sulfuric acid, polyoxyalkylene alkyl ether acetic acid, polyoxyalkylene alkenyl ether acetic acid, polyoxyalkylene alkylamido ether carboxylic acid, polyoxyalkylene alkenylamido ether carboxylic acid, or their salts with a C8-22 linear or branched-chain alkyl group or alkenyl group and at least one polyoxyalkylene group (average mole number added 1-20) selected from polyoxyethylene and polyoxypropylene.

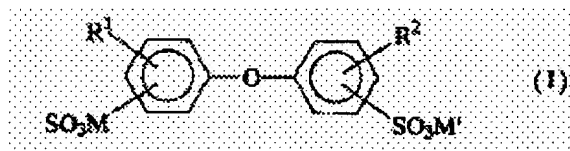
(3) C8-22 Alkyl or alkenyl sulfuric acid ester or salt thereof.

(4) C8-22 Saturated or unsaturated fatty acid or salts thereof.

(5) Diphenyl ether disulfonic acid-type anionic surfactant which can be represented by general formula (I)

[0010]

## Structure 1



[0011]

[wherein  $R^1$  and  $R^2$  are C6-22 linear or branched-chain alkyl groups or alkenyl groups or hydrogen atoms (but  $R^1$  and  $R^2$  cannot simultaneously be hydrogen atoms), and M and M' are hydrogen atoms, alkali metals, ammonium groups or alkanol-substituted ammonium groups].

[0012]

For the nonionic surfactant, those described in Japanese Kokai Patent Application No. Hei 9[1997]-359715 or Japanese Kokai Patent Application No. Hei 9[1997]-310091 (line 49, 10th column, p. 6, to line 40, 13th column, p. 8 can be given as examples, but among them the following (6)-(9) are preferable and (7)-(9) are especially preferable).

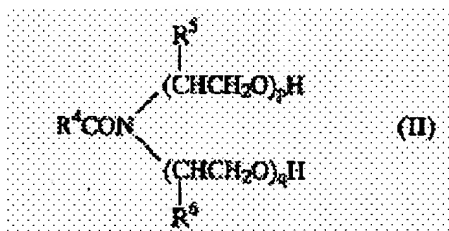
[0013]

(6) Polyoxyethylene alkyl or alkenyl ether with a C8-22 alkyl group or alkenyl group and the average number of moles of ethylene oxide added of 1-30.

(7) Higher fatty acid alkanolamides which can be represented by the following general formula (II) or alkylene oxide adducts thereof.

[0014]

Structure 2



[0015]

[wherein  $R^4$  is a C10-20 alkyl group or alkenyl group,  $R^5$  and  $R^6$  are identical or different and are hydrogen atoms or  $CH_3$ , p is 1-3, and q is 0-3].

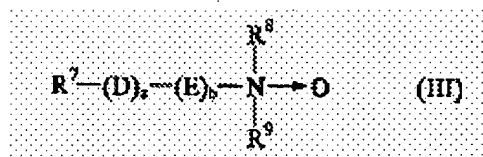
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[0016]

(8) Alkyl or alkenylamine oxide with a C1-24 linear or branched-chain alkyl group or alkenyl group. An alkylamine oxide that can be represented by the following general formula (III) is especially preferable.

[0017]

Structure 3



[0018]

[wherein  $\text{R}^7$  is a C8-24 alkyl group or alkenyl group,  $\text{R}^8$  and  $\text{R}^9$  are identical or different C1-3 alkyl groups, D is a  $-\text{NHC}(=\text{O})-$  group or a  $-\text{C}(=\text{O})\text{NH}-$  group, E is a C1-5 alkylene group, a and b are either  $a = 0$  and  $b = 0$  or  $a = 1$  and  $b = 1$ ]. In the above-mentioned general formula (III),  $\text{R}^7$  is a C8-24 alkyl group or alkenyl group, but especially preferably a C12-18 alkyl group.  $\text{R}^8$  and  $\text{R}^9$  are a C1-3 alkyl group, but a C1 methyl group is especially preferable.

[0019]

(9) Alkylpolysaccharides, especially preferably the alkylpolysaccharides which can be represented by the following general formula (IV)



[wherein  $\text{R}'$  is a linear or branched-chain C8-18 alkyl group, alkenyl group, or alkylphenyl group;  $\text{R}''$  is a C2-4 alkylene group; G is a residue derived from a C5-6 reducing sugar, x (average value) is 0-5, and y (average value) from proton NMR is 1-5].

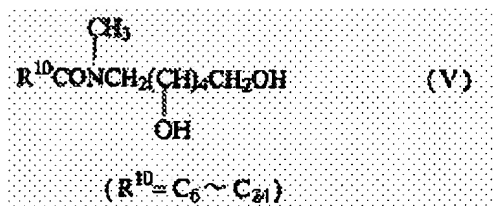
In general formula (IV), from the viewpoints of solubility, foamability, and detergency,  $\text{R}'$  is preferably linear and the number of carbons is preferably 10-14. From the viewpoint of solubility,  $\text{R}''$  is preferably C2-3. The x average value is preferably 0-2; the y average value is preferably 1-1.5. The value of y (degree of condensation of sugar) can be measured by NMR in accordance with the description in line 26, 10th column, p. 6, to line 15, 11th column, p. 7 of Japanese Kokai Patent Application No. Hei 8[1996]-53696, and G is preferably a residue derived from glucose.

[0020]

And the alkylmethylglucamide which can be represented by the following general formula (V) is also preferable.

[0021]

Structure 4



[0022]

Further, for the alkylpolysaccharide, a nonionic surfactant can be given as an example which contains at least one long-chain branched alkyl group or alkenyl group and at least three hydroxyl groups such as a one-mole adduct of pentaerythritol-isostearylglycidyl ether, one-mole adduct of sorbitol-isostearylglycidyl ether, one-mole adduct of mannitol-2-octyldodecylglycidyl ether, one-mole adduct of methylglucoside-isostearylglycidyl ether, one-mole adduct of diglycerin-isostearylglycidyl ether, phytanetriol, etc.

[0023]

In the present invention, in component (A), i.e., surfactant, it is preferable that 50-100 wt%, especially more preferably 80-100 wt% of the surfactant be a nonionic surfactant.

[0024]

Considering sufficient detergency and profitability, the component (A) content in the liquid detergent composition is preferably 0.01-10 wt%, more preferably 0.1-10 wt%.

[0025]

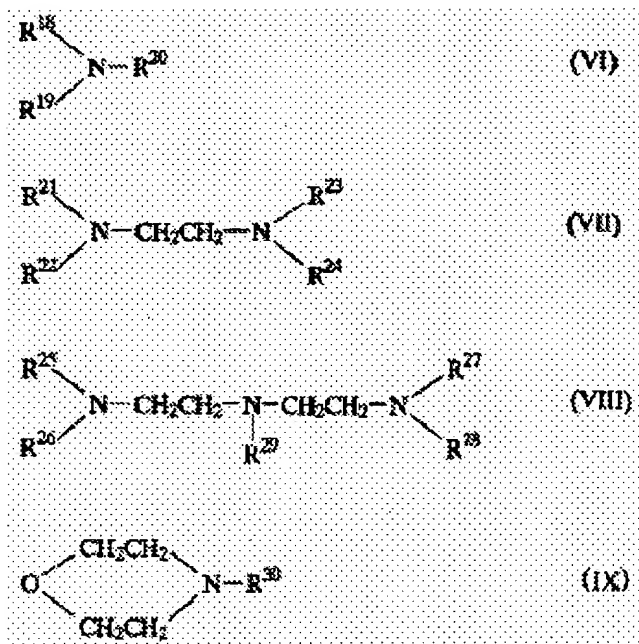
Component (B), which is a solvent, is preferably monopropylene glycol monobutyl ether, monopropylene glycol monopropyl ether, or monopropylene glycol monoethyl ether, and the component (B) content in the liquid detergent composition is preferably 0.05-15 wt%, more preferably 0.1-10 wt%.

[0026]

For component (C), which consists of amine compounds, at least one amine compound selected from the following general formulas (VI), (VII), (VIII), and (IX) is preferable.

[0027]

Structure 5



[0028]

[wherein R<sup>18</sup>, R<sup>21</sup>, R<sup>23</sup>, R<sup>25</sup>, R<sup>27</sup>, R<sup>29</sup>, and R<sup>30</sup> are hydrogen atoms or C1-4 alkyl groups, respectively and R<sup>19</sup>, R<sup>20</sup>, R<sup>22</sup>, R<sup>24</sup>, R<sup>26</sup>, and R<sup>28</sup> are hydrogen atoms, C1-4 alkyl groups or C2-4 hydroxyalkyl groups, respectively].

[0029]

Among the amine compounds that can be represented by these general formulas, at least one selected from the group consisting of ammonia, monoethanolamine, diethanolamine, triethanolamine, diethylaminoethanol, morpholine, and 2-amino-2-methyl-1-propanol is preferable.

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[0030]

From the viewpoint of detergency, the content of component (C), which consists of amine compounds, is preferably 3-10 wt%, more preferably 3-7 wt%.

[0031]

Further, the detergent composition of the present invention may also contain alkali such as a hydroxide, e.g., sodium hydroxide, potassium hydroxide, calcium hydroxide, etc.; a carbonate, e.g., sodium carbonate, potassium carbonate, sodium sesquicarbonate, etc.; a silicate, e.g., sodium



silicate, potassium silicate, etc. From the viewpoint of detergency the alkali content is 0.01-10 wt%, preferably 0.1-8 wt%, more preferably 0.5-5 wt%.

[0032]

In addition to the above-mentioned components, other components may be compounded into the liquid detergent composition of the present invention as long as the amount compounded is within the scope such that the compounding does not impair the objective of the present invention. Especially a low-temperature stabilizer such as a lower alcohol, e.g., ethanol, etc., ethylene glycol, a lower alkylbenzenesulfonic acid salt, e.g., a benzenesulfonic acid salt or a toluenesulfonic acid salt; an antioxidant such as 3,5-di-tert-butyl-4-hydroxytoluene, 2,5-di-tert-butylhydroquinone, and DL- $\alpha$ -tocopherol, etc.; a perfume; a pigment; and a preservative may be compounded into the liquid detergent composition of the present invention. And others such as 3-methyl-1,3-butanediol, 3-methyl-1,5-pentanediol, 2,2,4-trimethyl-1,3-pentanediol, 2-ethyl-1,3-hexanediol, 1,9-nonanediol, 1,8-octanediol, or other diols may be compounded into the liquid detergent composition of the present invention as long as they do not impair the stability of the scent.

[0033]

Together with the above-mentioned components, water is compounded into the liquid detergent composition of the present invention. The quantity of water to be compounded is the quantity needed to adjust the total to 100 wt%, and for the liquid detergent composition of the present invention the pH is preferably 10-13.

[0034]

The liquid detergent composition of the present invention is used for cleaning hard materials and is especially effective in removing stains from plastic products. Additionally, the liquid detergent composition of the present invention can be used as a detergent for bathrooms, kitchens, beds, household electric appliances, tableware, fully automatic washing machines, drainpipes, and small articles in kitchens and bathrooms.

[0035]

Application examples

Application Examples 1-12 and Comparative Examples 1-8

The components shown in Tables 1 and 2 were mixed together at the ratios shown in the tables, then, while stirring, the pH was adjusted with an aqueous NaOH or HCl solution to prepare the compositions shown in the tables. Each composition was used and the oil stain

removability of the compositions and the damage to plastics (damage to ABS polymer) was tested by the following method. The results are shown in Tables 1-2. The details of the components compounded are shown below.

[0036]

- Alkylglucosides: those in which the R' in general formula (IV) is a linear C12 alkyl group, G is a glucose residue,  $x = 0$  and  $y = 1.4$ .
- Alkylamine oxides: those monoalkyldimethylamine oxides with a linear C12 alkyl group.
- Alkylsulfuric acid ester sodium salts: those with a linear C12 alkyl group.
- Polyoxyethylene alkyl ether sodium sulfates: those with a linear C12 alkyl group and an average number of moles of ethylene oxide added of 4.0.
- Alkylcarbobetaines: Alkylamidopropylcarbobetaines with a linear C12 alkyl group.
- Alkyltrimethylammonium chlorides: those with a linear C12 alkyl group.
- Sodium alkylbenzenesulfonates: those with a linear C12 alkyl group.

[0037]

<Method for assessment of detergency>

The liquid detergent compositions shown in Tables 1 and 2 were used to clean grease stains on gas ranges in general household kitchens, and then their detergency was assessed. In the assessment of the detergency of the detergent compositions for removing the grease stains on the gas ranges in the kitchens, the grease stains on the ranges were sprayed with 3 cc of commercially available spray cleaner, followed by wiping with a dry cloth, and wiping with a wrung wet cloth, and then the sensory test was carried out according to the following standards.

Standard of assessment

Detergency

- 5: complete removal of grease stains
- 4: 80% removal of grease stains
- 3: 60% removal of grease stains
- 2: 40% removal of grease stains
- 1: 20% removal of grease stains
- 0: no removal of grease stains.

The numerical values in the tables are the averages of values obtained when the same treatment was carried out 20 times.

[0038]

<Method for assessment of damage to ABS polymer>

An ABS polymer (Mitsubishi Monsanto Chemical Co.) test piece (230 mm x 35 mm x 2 mm) was prepared. Then the test piece was fixed on the surface of a PVC pipe (diameter: 267 mm) as shown in Figure 1 and a 0.74% strain was created as shown in Figure 2. The strain was calculated using the following formula.

[0039]

Mathematical formula 1

$$\text{Strain (\%)} = (l - L)/L \times 100$$

[0040]

The strained ABS polymer was wiped 10 times (one wipe equals one forward-backward wiping), with a commercially available paper towel (weight of 1 g when dry) impregnated with 1.7 g aqueous detergent solution; then it was allowed to stand at 20°C and 65% RH for 24 h, and then the damage to the ABS polymer was assessed visually. The standard for the assessment was as follows:

O: normal

X: cracks

[0041]

Table 1

| ① 配合成分(重量%)                | ⑬ 実 施 例 |     |     |     |     |     |     |     |     |     |     |     |
|----------------------------|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                            | 1       | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  |
| ② アルキルグリコシド                | 3       |     | 1.5 | 2   | 1   | 3   | 1   | 5   | 1   |     |     |     |
| ③ アルキルアミノオキシド              |         | 3   | 1.5 | 1   | 2   |     | 1   |     | 3   |     |     |     |
| ④ アルキル硫酸エステルナトリウム          |         |     |     |     |     |     |     |     |     | 3   |     |     |
| ⑤ ポリオキシエチレンアルキルエーテル硫酸ナトリウム |         |     |     |     |     |     |     |     |     |     | 2.5 |     |
| ⑥ アルキルカルボベタイン              |         |     |     |     |     |     |     |     |     |     |     | 3   |
| ⑦ アルキルトリメチルアンモニウムクロリド      |         |     |     |     |     |     |     |     |     |     | 0.5 |     |
| ⑧ モノプロピレングリコールモノブチルエーテル    | 3       |     | 3   |     | 2   |     | 1   | 7   |     | 3   |     | 2.5 |
| ⑨ モノプロピレングリコールモノプロピルエーテル   |         | 2   |     |     |     |     | 1   |     | 3   |     | 4   |     |
| ⑩ モノプロピレングリコールモノエチルエーテル    |         |     |     | 3   |     | 7   |     |     |     |     |     |     |
| ⑪ モノエタノールアミン               | 5       | 6   | 5   | 4   | 7   | 6   | 4   | 3   | 7   | 5   | 5   | 5   |
| ⑫ 水                        | ⑬ 残部    | 残部  | 残部  | 残部  | 残部  | 残部  | 残部  | 残部  | 残部  | 残部  | 残部  | 残部  |
| ⑬ 合 計 (重量%)                | 100     | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| pH                         | 12      | 13  | 12  | 11  | 13  | 12  | 11  | 8   | 13  | 12  | 12  | 12  |
| ⑭ 油汚れ洗浄力                   | 4.9     | 4.6 | 5.0 | 4.5 | 5.0 | 4.0 | 4.8 | 4.3 | 6.0 | 4.2 | 4.8 | 4.2 |
| ⑮ ABS樹脂損傷性                 | ○       | ○   | ○   | ○   | ○   | ○   | ○   | ○   | ○   | ○   | ○   | ○   |

- Key: 1 Component compounded (wt%)  
 2 Alkyglycoside  
 3 Alkylamine oxide  
 4 Alkylsulfuric acid ester sodium salt  
 5 Polyoxyethylene alkyl ether sodium sulfate  
 6 Alkylcarbobetaine  
 7 Alkyltrimethylammonium chloride  
 8 Monopropylene glycol monobutyl ether  
 9 Monopropylene glycol monopropyl ether  
 10 Monopropylene glycol monoethyl ether  
 11 Monoethanolamine  
 12 Water  
 13 Total (wt%)  
 14 Detergency for removing grease stain  
 15 Damage to ABS polymer  
 16 Application Example  
 17 Balance

[0042]

Table 2

| ① 配合成分(重量%)              | ⑫ 比較例 |     |     |     |     |     |     |      |
|--------------------------|-------|-----|-----|-----|-----|-----|-----|------|
|                          | 1     | 2   | 3   | 4   | 5   | 6   | 7   | 8    |
| ② アルキルベンゼンスルホン酸ナトリウム     | 3     |     | 3   | 2   | 2   | 1   | 3   | 1    |
| ③ アルキルアミノオキサイド           |       | 2   |     | 1   |     | 1   |     | 2    |
| ④ テトラエチレングリコールモノブチルエーテル  | 3     |     |     | 1   |     |     | 2   |      |
| ⑤ トリプロピレングリコールモノブチルエーテル  |       | 3   |     |     |     |     |     | 1    |
| ⑥ ブチルエーテルEO3モルPO1.2モル付加物 |       |     | 3   |     | 2   | 3   |     |      |
| ⑦ モノエタノールアミン             | 5     | 5   | 5   | 6   | 3   | 2   | 4   | 6    |
| ⑧ 水                      | ⑬ 残部  | 残部  | 残部  | 残部  | 残部  | 残部  | 残部  | 残部 ⑬ |
| ⑨ 合計(重量%)                | 100   | 100 | 100 | 100 | 100 | 100 | 100 | 100  |
| pH                       | 12    | 12  | 12  | 13  | 11  | 5   | 8   | 13   |
| ⑩ 油污れ洗浄力                 | 2.1   | 3.8 | 2.3 | 1.7 | 1.9 | 1.2 | 1.5 | 3.0  |
| ⑪ ABS樹脂侵蝕性               | ×     | ×   | ×   | ×   | ×   | ×   | ×   | ×    |

- Key:
- 1 Component compounded (wt%)
  - 2 Sodium alkylbenzenesulfonate
  - 3 Alkylamine oxide
  - 4 Tetraethylene glycol monobutyl ether
  - 5 Tripropylene glycol monobutyl ether
  - 6 EO (3 mole)-PO (1.2 mole) adduct butyl ether
  - 7 Monoethanolamine
  - 8 Water
  - 9 Total (wt%)
  - 10 Detergency for removing grease stain
  - 11 Damage to ABS polymer
  - 12 Comparative Example
  - 13 Balance

#### Brief description of the figures

Figure 1 shows a sketch for explaining the method for testing the damage of a base material.

Figure 2 shows a cross-sectional view of an ABS polymer test piece for explaining the method for testing damage to a base material.

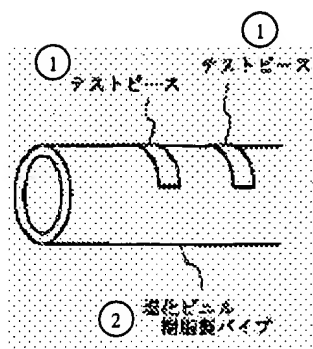


Figure 1

Key: 1 Test piece  
2 PVC pipe

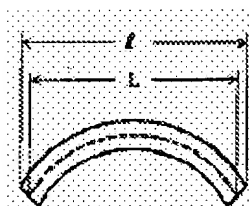


Figure 2